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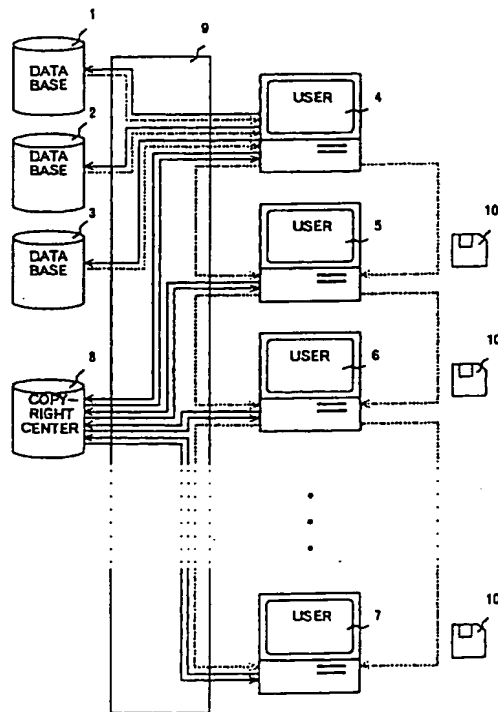
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(54) Data content dealing system

(57) A system for dealing in an original data content and an edited data content is provided. A data content is handled as an object, and the data content is edited by editing a data content, which is an object by using an edit program. The edited data content is expressed by the original data content and the editing scenario which describes details of editing by the edit program. Only the encrypted editing scenario is dealt in. Upon receipt of the encrypted editing scenario, a user decrypts the encrypted editing scenario using a crypt key obtained from a key management center, and obtains the original data content from the database in accordance with the editing scenario and re-constitutes the edited data content. In case there is the one who wishes sale of the editing scenario, its utilization right is sold by auction.

Fig. 1



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Description

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

The present invention relates to a system for managing copyrights in dealing in copyrighted digital data content, i.e., dealing in original digital data content and edited digital data content.

BACKGROUND ART

Because analog data content is deteriorated in quality whenever storing, copying, editing, or transferring it, controlling copyrights associated with these operations has not been a serious problem. However, because digital data content is not deteriorated in quality after repeatedly storing, copying, editing, or transferring it, such controlling copyrights associated with these operation is a serious problem.

Because there has been hitherto no adequate method for controlling a copyright for digital data content, the copyright is handled by the copyright law or contracts. Even in the copyright law, compensation money for a digital-type sound-or picture-recorder is only systematized.

Use of a data content includes not only referring to its contents but also normally effectively using by storing, copying, or editing obtained data content by a user. Moreover, it is possible to transmit data content which is edited by a user to another person via on-line basis by a communication line or via off-line basis using a proper recording medium. Furthermore, it is possible to transmit the edited data content to the database to be registered as new data content. In such a case, the user who has edited the data content may also be an information provider.

Under these circumstances, how to handle a copyright of data content in a database is a large problem. However, there has not been adequate copyright management means for solving the problem so far, particularly copyright management means completed for secondary utilization such as copying, editing, or transferring of the data content.

The inventor of the present invention proposed a system for managing a copyright by obtaining a permit key from a key control center via a public telephone line in Japanese Patent Laid-Open No. 46419/1994 (GB 2269302A) and Japanese Patent Laid-Open No. 141004/1994 (U.S. Patent No.5,504,933) and moreover, proposed an apparatus for managing the copyright in Japanese Patent Laid-Open No. 132916/1994 (GB 2272822A).

Moreover, a copyright management method for primary utilization of digital data content such as display (including process to sound) or storage including real-time transmission of the digital data content in a data-

base system and secondary utilization of the digital data content such as copying, editing, or transferring of the digital data content by further developing the above invention is proposed in Japanese Patent Laid-Open No. 271865/1995, EP 677949A2 (U.S. patent application serial No. 08/416,037).

The database copyrights management system of the above application in order to manage the copyright, either one or more of a program for managing the copyright, copyright information, and a copyright control message are used in addition to a use permit key corresponding to a requested use, and data content which has been transferred with encrypted is decrypted to be used for viewing and editing, and the data content is encrypted again when used for storing, copying and transferring.

The copyright control message is displayed when utilization beyond the range of the user's request or authorized operation is found to give caution or warning to a user and the copyright management program performs decryption/encryption of the data content, and also watching and managing so that utilization beyond the range of the user's request or authorized operation is not performed.

The inventor also proposed in Japanese Patent Patent Laid-open No. 185448/1996, EP publication No. EP 704785A2 (U.S. patent application serial No. 08/536,747) a system for specifically implementing a database copyright management system.

The above-mentioned system comprises a key management center that manages a crypt key and a copyright management center that manages the database copyright. According to this system, all of the data contents delivered from a database is encrypted by a first crypt key, and a first user who wishes to use data content directly from the database requests the key management center the key corresponding to the specific usage by presenting information on the first user to the center. In response to the primary usage request from the first user, the key management center transfers the information on the first user to the copyright management center. On receiving the information, the copyright management center transfers this information together with a copyright management program to the key management center. On receiving the copyright management program, the key management center transfers the first crypt key corresponding to the specific usage and a second crypt key K2 together with the copyright management program to the first user via a communication network. On receiving the first crypt key, the first user uses this key to decrypt the data content for usage. The user uses the second crypt key to encrypt and decrypt data content when subsequently storing, copying or transmitting the data content.

If data content is copied to an external record medium or transmitted without being stored, the first and second crypt keys are abandoned. If the first user wishes to use the data content again, the first and sec-

ond crypt keys are re-delivered to the user from the copyright management center. The re-delivery of the second crypt key indicates a confirmation that the data content has been copied or transferred to a second user, and this is recorded in the copyright management center.

In requesting secondary usage to the copyright management center, the second user presents the information on the first user and information on the original copyright to the copyright management center. The copyright management center transmits to the second user a permit key corresponding to the specific usage, together with a second crypt key (viewing permit key), a third crypt key (a permit key corresponding to the specific usage), and the copyright management program which have been encrypted.

On the other hand, it is widely practiced to establish LAN (Local Area Network) by connecting computers with each other in offices, organizations, companies, etc. Also, a plurality of networks are connected with each other, and Internet is now organized in global scale, by which a plurality of networks are utilized as if they are a single network.

In LAN used in an organization such as a firm, secret information is often stored, which must not be disclosed to outsiders.

For this reason, it is necessary to arrange the secret information in such manner that only a specific group of users can gain access and use such information, and such access is generally placed under control to prevent leakage of secret information to outsiders.

There are roughly two methods to control the access: a method to control access with access permission, and a method to do it by encryption.

The method of access control by access permission is described in U.S. Patent Nos. 5,173,939, 5,220,604, 5,224,163, 5,315,657, 5,414,772 and 5,438,508, in EP 506435, and in JP Laid-Open 169540/1987.

The access control method based on encryption is disclosed in U.S. Patent Nos. 4,736,422, 5,224,163, 5,400,403, 5,457,746, and 5,584,023, in EP 438154 and EP 506435, and in JP Laid-Open 145923/1993. The access control method based on encryption and digital signature is described in U.S. Patent Nos. 4,919,545 and 5,465,299.

Intranet is now being propagated, in which a plurality of LANs are connected with each other via Internet and these LANs are utilized as if they are a single LAN. In the intranet, information exchange is performed via Internet, which basically provides no guarantee for prevention of privacy, and information is encrypted to prevent the privacy when secret information is exchanged.

The prevention of information privacy during transmission by means of encryption is disclosed in U.S. Patent Nos. 5,504,818 and 5,515,441, and the use of a plurality of crypt keys is described in U.S. Patent Nos. 5,504,816, 5,353,351, 5,475,757, and 5,381,480. Also,

performing re-encryption is described in U.S. Patent No. 5,479,514.

When encrypting, management of a crypt key including transfer and receipt of the crypt key becomes an important issue. Generation of keys by IC card is disclosed in U.S. Patent No. 5,577,121, and encryption/decryption by IC card is disclosed in U.S. Patent Nos. 5,347,581 and 5,504,817.

Also, electronic watermark technique is described in EP 649074.

With recent development of computer network system, individual computers, used on stand-alone basis in the past, are connected together through the network system, and database system to commonly share the data is now propagated. Further, distributed object system has been proposed, in which application program or basic software called operating system as well as data is also commonly shared through the network.

In the distributed object system, both data content and software are supplied by a server as an object, which comprises program and data.

In the distributed object system, there are two systems, i.e. a system called object container, in which operating system, application program and data content are provided by a server and data content processing and data content storage are performed by a user terminal unit, which is an ordinary computer, and a system called server object, in which operating system, application program and data content are provided by a server, and data content processing is performed by a user terminal unit called network computer, while data content storage is carried out by the server. A system is further developed, in which data content processing is also performed by the server, and the user terminal unit is provided only with input/output function, and the whole system functions as a single computer.

Further, there is a method of so-called object oriented programming performing various processings by using "object" integrated with data content and program handling data content, instead of general form file consisting of data header and data body.

In object, a storing portion called as "slot" in an envelope called as "instance" accommodates data called as "instance variable". The slot is surrounded by one or more of procedures called as "method" for referring, processing, binding and so on, and the instance variable can be referred to or operated only via "method". This function is called as "encapsulation". Instruction from outside for make the "method" refer to or operate the instance variable is called as "message".

This means, in another view, the instance variable which is impossible to be referred to or operated without through "method" is protected by the "method". Then, this can be used for encrypting the "method" and allowing the instance variable to be referred to or operated only by "message" which can decrypt the encrypted "method".

In this case also, similarly to the case of data having

general file form, since if entire "method" is encrypted, it is impossible to utilize "object", a part of the "method" is not encrypted.

Another form of the network system called "license network" as rental network system, is considered. In this system, an enterprise providing network base such as communication lines also provides the systems other than communication lines such as fee charging system, security system, copyright management system, certification system, etc. And a service enterprise utilizes these services and carries out network business as if it is his own system.

Then, basic encryption-related technique used in the present invention will be described below.

--Crypt key--

Secret-key system is also called "common key system" because the same key is used for encryption and decryption, and because it is necessary to keep the key in secret, it is also called "secret-key system". Typical examples of encryption algorithm using secret-key are: DES (Data Encryption Standard) system of National Bureau of Standards, FEAL (Fast Encryption Algorithm) system of NTT, and MISTY system of Mitsubishi Electric Corp. In the embodiments described below, the secret-key is referred as "Ks".

In contrast, the public-key system is a cryptosystem using a public-key being made public and a private-key, which is maintained in secret to those other than the owner of the key. One key is used for encryption and the other key is used for decryption. Typical example is RSA public-key system. In this specification, the public-key is referred as "Kb", and the private-key is referred as "Kv".

Here, the operation to encrypt data content, a plain text material M to a cryptogram Cmks using a secret-key Ks is expressed as:

$$Cmks = E(M, Ks).$$

The operation to decrypt the cryptogram Cmks to the plain text data content M using a crypt key Ks is expressed as:

$$M = D(Cmks, Ks).$$

Also, the operation to encrypt the plain text data content M to a cryptogram Cmkb using a public-key Kb is expressed as:

$$Cmkb = E(M, Kb).$$

The operation to decrypt the cryptogram Cmkb to the plain text data content M using the private-key Kv is expressed as:

$$M = D(Cmkb, Kv).$$

The operation to encrypt the plain text data content M to a cryptogram Cmkv using a private-key Kv is expressed as:

$$Cmkv = E(M, Kv),$$

and the operation to decrypt the cryptogram Ckv to the plain text data content M using the public-key Kb is expressed as:

$$M = D(Cmkv, Kb).$$

The encryption technique is the means to exclude illegitimate use of data content, but perfect operation is not guaranteed. Thus, the possibility of illegitimate use of data content cannot be completely excluded.

On the other hand, electronic watermark technique cannot exclude the possibility of illegitimate use, but if illegitimate use is detected, it is possible to check the illegitimate use by verifying the content of electronic watermark, and there are a number of methods in this technique. These methods are described in Nikkei Electronics, No.683, 2-24-1997, pp.99-124, "Digital watermark" to help stop to use illegal proprietary digital works in the multimedia age". Also, description is given on this technique by Walter Bender et al., "Introducing data-hiding technology to support digital watermark for protecting copyrights", IBM System Journal, vol. 35, Nos. 3 & 4, International Business Machines Corporation.

SUMMARY OF THE INVENTION

In the present application, it is proposed to provide a system for dealing in an original data content and an edited data content.

In the present application, a data content is handled as an object, and the data content, functioning as an object, is edited in accordance with an edit program. Therefore, the edited data content can be expressed by the original data content and an editing scenario, which describes the edit detail based on the edit program. As the original data content to be utilized, there are, in addition to the one stored in the database, those prepared originally by the data editor. The data content prepared by the data editor can also be handled in the same manner as the other data by storing it in the database. In this case, only the encrypted editing scenario is dealt in, and when the user obtains the encrypted editing scenario, the user decrypts the encrypted editing scenario by using a crypt key obtained from a key management center, and obtains the original data content from the database in accordance with the editing scenario and re-constitutes the edited data content.

In case there is the one who wishes sale of the editing scenario, its utilization right is sold by auction.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a block diagram of an embodiment of a data management system.

Figure 2 illustrates an example of producing new data content using a plurality of data contents as objects.

Figure 3 is a block diagram of another embodiment of a data management system.

Figure 4 is an outlined block diagram of an embodiment of a data content dealing system.

Figure 5 is an outlined block diagram of another embodiment of a data content dealing system.

Figure 6 is an outlined block diagram of yet another

embodiment of a data content dealing system.

Figure 7 is an outlined block diagram of a system dealing in an editing scenario.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments are described as below referring to the accompanied drawings.

The edit processing of data content is performed by editing the original copyrighted data using an edit tool, which is an application program. The edited data content obtained by editing can be expressed by the utilized original data content, the information of the used edit tool and the editing process data. Specifically, in case the edit tool is available, it is possible to reproduce the edited data content by obtaining the original copyrighted data and the editing process data.

Description on editing digital data at first will be given.

Because digital data content is edited by using an edit program (edit tool) and thereby altering original data content edited data content can be reproduced as the original data content, edit tool and editing process data content (editing scenario) are specified. In other words, unless the original data content, edit tool and the editing scenario are specified, it is impossible to reproduce the edited data content.

To produce new data content from single original data content, there are a case in which edited data content {A'} is obtained by altering original data content A; a case in which edited data content {A + X} is obtained by adding data content X to the original data content A by a user; a case in which edited data content {A''} is obtained by dividing the original data content A into original data content elements A1, A2, A3, and changing the arrangement of the elements to such as A3, A2 and A1; and a case in which edited data content {A1 + X1 + A2 + X2 + A3 + X3} is obtained by dividing the original data content A into original data content elements A1, A2, A3,, also dividing the data content X of the user into X1, X2, X3, and arranging these elements.

In these cases, alteration of original data content, change of original data content arrangement, combination of the original data content with user data content, and division of the original data content and combination of it with the user data content use respectively a secondary copyright, which is necessary to be protected. The original copyright of the user, of course, exists in the data content X added by the user.

To produce new data content by combining a plurality of original data contents, there are, for example, a case in which edited data content {A + B + C} is obtained by simply combining original data contents A, B, C,, a case in which edited data content such as {A + X} is obtained by adding data content X to the original data content A, B, C,, a case in which edited

data content {A1 + B1 + C1 + + A2 + B2 + C2 + + A3 + B3 + C3 +} is obtained by dividing the original data content A, B, C, into original data content elements A1, A2, A3,, B1, B2, B3,, and C1, C2, C3,, combining them, and changing their arrangements; and a case in which edited data content {A1 + B1 + C1 + X1 + + A2 + B2 + C2 + X2 + + A3 + B3 + C3 + X3 +} is obtained by dividing the original data content A, B, C, into original data content elements A1, A2, A3,, B1, B2, B3,, and C1, C2, C3,, combining with the elements of user data content X1, X2, X3,, and changing their arrangements.

Also in these cases, combination of a plurality of original data contents, combination of a plurality of original data contents with user data content, division of a plurality of original data contents and change of the arrangements, and combination of divided plurality of original data contents with the user data content arise respectively a secondary copyright, which is necessary to be protected. Also, the original copyright of the user, of course, exists in the data content X1, X2, X3, added by the user.

[Embodiment 1]

The description of Embodiment 1 will be given below referring to the drawing.

Figure 1 shows a schematic view of a data copyrights management system in which a user edits one original copyrighted data and transfers it to a next user.

In the embodiment, reference numerals 1, 2, and 3 represent databases that store text data or binary, audio, and/or picture data constituting computer graphics screens or programs, which is not encrypted; 9 is a communication line such as a public telephone line provided by a communication company or a CATV line provided by a cable television enterprise; 10 is a recording medium such as a flexible disk; 4 is a first user terminal; 5 is a second user terminal; 6 is a third user terminal; and 7 is an n-th user terminal. Reference numeral 8 represents a copyright management center for managing the data copyright.

The databases 1, 2, and 3, copyright management center 8, first user terminal 4, second user terminal 5, third user terminal 6, and n-th user terminal 7 are connected to the communication line 9. In Figure 1, encrypted data content is transmitted via the path shown by a broken line, requests are transmitted from user terminal 4, 5, 6, or 7 to database 1, 2, or 3 and copyright management center 8 via the path shown by a solid line. The permit key, copyright management program, and crypt key corresponding to a specific usage are transmitted from database 1, 2, or 3 and copyright management center 8 to user terminal 4, 5, 6, or 7 via the path shown by an one-dot chain line.

The Embodiment 1 employs a first public-key Kb1, a first private-key Kv1 corresponding to the first public-key Kb1, a second public-key Kb2, and a second pri-

vate-key Kv2 corresponding to the second public-key Kb2 that are prepared by a first user, and a first secret-key Ks1 and a second secret-key Ks2 prepared by the database. The database uses the first secret-key Ks1 to encrypt data content M:

$$\text{Cmks1} = E(M, \text{Ks1})$$

and further encrypts the first secret-key Ks1 by the first public-key Kb1:

$$\text{Cks1kb1} = E(\text{Ks1}, \text{Kb1})$$

and the second secret-key Ks2 by the second public-key Kb2:

$$\text{Cks2kb2} = E(\text{Ks2}, \text{Kb2}).$$

The database then transmits these encrypted data content Cmks1 and the first and the second secret-keys Cks1kb1 and Cks2kb2 to the first user.

The first user decrypts the encrypted first secret-key Cks1kb1 using the first private-key Kv1:

$$\text{Ks1} = D(\text{Kv1}, \text{Cks1kb1}),$$

and decrypts the encrypted data content Cmks1 by the decrypted first secret-key Ks1:

$$M = D(\text{Ks1}, \text{Cmks1})$$

and uses it. The user decrypts encrypted second secret-key Cks2kb2 by the second private-key Kv2:

$$\text{Ks2} = D(\text{Kv2}, \text{Cks2kb2}),$$

which is subsequently used as a key for encrypting/decrypting when storing, copying, or transmitting data content.

If the first user copies data content obtained and then supplies it to second user, the data content does not involve the copyright of the first user because no modifications have been made to the data content. If, however, first user produces new data content based on the data content obtained or using a means for combining the original data content with other data content, the new data content involves a secondary copyright for first user, and the first user has the original copyright for this secondary work.

Similarly, if second user produces further new data content based on the data content obtained from the first user or combining with other data content, the new data content involves a secondary copyright for the second user, and the second user has the original copyright of this secondary work.

Databases 1, 2, and 3 store text data content or binary, digital audio, or digital picture data content constituting computer graphics screens or programs. This data content is encrypted when read out and supplied to the user terminal 4 via communication line 9 during a data content read operation in response to a request from the first user terminal 4.

The method of managing copyrights of data obtained from a database is described in Japanese Patent Application 1994-237673 (JP Laid Open 1996-185448, U.S. Patent Application Serial No. 08/536,747, EP 704785A2).

As shown in Figure 2, first user extracts parts M4, M5 and M6 constituting data content from a plurality of data contents M1, M2 and M3 obtained from one or

more databases, and produces new data content M7 using these parts M4, M5 and M6.

First user supplies new data content M7 to second user. New data content M7 involves a secondary copyright associated with the editing of original data contents M1, M2 and M3 as well as the original copyright for original data contents M1, M2 and M3, which are material of parts M4, M5 and M6 to be produced new data content M7.

The original data contents M1, M2 and M3 are encrypted using each of the second secret-keys Ks21, Ks22, Ks23 supplied with each of data contents M1, M2 and M3 when used for operations other than display; i.e., store, edit, copy or transmit:

$$\text{Cm1ks21} = E(M1, \text{Ks21})$$

$$\text{Cm2ks22} = E(M2, \text{Ks22})$$

$$\text{Cm3ks23} = E(M3, \text{Ks23}).$$

The data content parts M4, M5 and M6, of original data contents are also encrypted using each of the second secret-keys Ks21, Ks22, Ks23 supplied with each of the original data contents when used for operations other than display:

$$\text{Cm4ks21} = E(M4, \text{Ks21})$$

$$\text{Cm5ks22} = E(M5, \text{Ks22})$$

$$\text{Cm6ks23} = E(M6, \text{Ks23}).$$

First user who has edited the data content performs a digital signature for edit program Pe using first private-key Kv1:

$$\text{Spe} = D(\text{Pe}, \text{Kv1})$$

and supplies encrypted original data content parts Cm4ks21, Cm5ks22 and Cm6ks23 to second user together with the edit program Pe with the digital signature, via communication line 9 or by stored into the recording medium 10.

Upon receipt of the encrypted original data content parts Cm4ks21, Cm5ks22 and Cm6ks23, and the edit program Pe, second user requests second secret-keys Ks21, Ks22, Ks23 for decryption of the encrypted original data content parts Cm4ks21, Cm5ks22 and Cm6ks23 by presenting the edit program Pe with the digital signature, to the copyright management center 8.

Data copyright management center 8 identifies first user from the presented digital signature Spe in the edit program, using the first public-key Kb1:

$$\text{Pe} = E(\text{Spe}, \text{Kb1}),$$

and determines if first user is a valid user to use the original data content to which the second secret-keys Ks21, Ks22, Ks23 correspond. If the first user is the valid user, the center transmits the second secret-keys Ks21, Ks22, Ks23 to second user. Otherwise, it does not transmit the second secret-keys Ks21, Ks22, Ks23 to the second user.

The digital signature Spe presented to the copyright management center is registered in the center as a valid procedure for authorizing the first user being a secondary copyright owner.

While the above data content editing of original data content can be performed by using an edit program

corresponding to the original data content, by handling the original data content as object-oriented software, it is possible to facilitate further editing of data content and manage more preferably copyrights of data content.

Moreover, by adopting agent-oriented software, a user can synthesize data content with little labor.

The agent-oriented software, unlike the conventional one, is a program having autonomy, flexibility and cooperativeness, which is able to meet a user's request with its characteristics of autonomy, flexibility and cooperativeness in accordance with only a general instruction of the user without specifically giving every operation instruction to the software.

By incorporating the agent program into a basic system of a data copyright management system so that the database utilization of a user is monitored, and it is arranged that information including data utilization condition and charging is collected at the database or the copyright management center, using metering function placed in a user terminal, and thus, it is possible to know the database utilization condition of the user at the database side or the copyright management center side and achieve more accurate copyright management. The agent program and its data are also necessary to be protected in copyrights, and therefore, are encrypted like original data content.

The copyrighted data can be handled in the computer programming or processing as "object" integrated of program and data content.

[Embodiment 2]

Embodiment 2 is described referring to Figure 3. This embodiment uses first secret-key Ks1, second secret-key Ks2, third secret-key Ks3, plaintext original copyright label Lc0 and plaintext copyright management program Pc.

The data copyright management system shown in Figure 3 comprises database 11, key control center 12, users 13, 13, 13 ... and a communication line 14 that connects these entities. Database 11 receives data content from information providers (IP) 15, 15, 15.... However, in some cases, data content is supplied directly to users 13 from information providers 16, 16, 16 ... via communication line 14 without database 11 intervening.

The data content used in the invention is the object comprising combined program and data content. Data content is supplied from information providers 15, 15, 15 ... to database 11 and to first users 13. However, in some cases, data content is supplied from information providers 16, 16, 16 ... via communication line 14 or via information record medium 17 such as CD-ROM or the like directly to first users 13 without database 11 intervening.

The solid line, broken line and one-dot chain line in this Figure 3 show the path for data content and requests for crypt keys, path of encrypted data content

and path of crypt keys, respectively.

First users 13 are not merely users but can be information providers 15 or 16 that provide new data content (secondary copyrighted data) by combining or revising a plurality of obtained original data contents.

In the data copyrights management system, the original data content provided by each of information providers 15 and 16 has been encrypted to protect the copyright. Therefore, the encrypted original data content obtained by first user 13 needs to be decrypted in using. All of the crypt keys for the decryption are deposited in the key control center 12 to be controlled by the center.

Each information provider 15 or 16 can adopt freely any cryptosystem. However, the cryptosystem described later and used after secondary utilization of data content is limited to one adopted by the key control center 12.

In this system, plaintext original data content M0 is encrypted by first secret-key Ks1:

$$Cm0ks1 = E(M0, Ks1),$$

and is provided to the first user 13 from information provider 15 via database 11 and communication line 14, or from information provider 16 via communication line 14, or via information recording medium 17 such as CD-ROM, together with original copyright label Lc0.

Plaintext original copyright label Lc0 is attached to encrypted original data content Cm0ks1 provided for the first user 13, and is used for obtaining primary use permit keys, etc. Namely, encrypted original data content Cm0ks1 includes plaintext original copyright label Lc0 and encrypted original data content Cm0ks1. The name of application programs in use, outlined explanation, fees and charging method are entered into plaintext original copyright label Lc0 in addition to general information including the name of original creator, title name and creation date of the original data content. The number of a crypt key is also entered if necessary. Digital signature by original creator added to plaintext original copyright label Lc0 can prevent false copyright claiming.

The first user 13 who requires use of encrypted original data content Cm0ks1 makes a request to key control center 12 via communication line 14 for distributing a primary use permit key Ks1 by presenting original copyright label Lc0.

Key control center 12 that has identified the secret-key as first secret-key Ks1 to be distributed, by presented original copyright label Lc0, distributes this first secret-key Ks1 to the first user 13 via communication line 14. Upon receipt of distributed first secret-key Ks1, the device of the first user 13 is turned to the copyright management mode, and the first user 13 can use the original data content.

On the other hand, key control center 12 charges a fee as well as grasps the use condition of original data content and of the database used by the first user 13.

The first user 13 decrypts encrypted original data

content Cm0ks1 using first secret-key Ks1:

$$M0 = D(Cm0ks1, Ks1),$$

and uses it.

When decrypted original data content M0 is stored in the first user 13 device, it is encrypted again by first secret-key Ks1

$$Cm0ks1 = E(M0, Ks1)$$

and re-encrypted original data content Cm0ks1 is stored.

For repeated use of re-encrypted original data content Cm0ks1, repeated decryption and encryption are carried out using first secret-key Ks1.

The first user 13 who requires to edit original data content M0 makes a request to key control center 12 for distributing second secret-key Ks2 via communication line 14.

Upon receipt of the request for distributing second secret-key Ks2, key control center 12 distributes second secret-key Ks2 to the first user 13 via communication line 14. The first user 13 receives second secret-key Ks2, edits original data content M0 and obtains half-way edited data content M0'.

When half-way edited data content M0' is stored in the user 13 device, it is encrypted by second secret-key Ks2:

$$Cm0'ks2 = E(M0', Ks2).$$

When the edit is finally completed, the first user 13 prepares third secret-key Ks3 in order to execute the secondary copyright with reference to the data content editing of final edited data content M1, and registers third secret-key Ks3 into key control center 12. The key control center 12 also may prepare third secret-key Ks3 and distribute it in response to a request from the first user 13.

When the first user 13 copies edited data content M1 into external recording medium 18 or transfers it via communication line 14, it is encrypted by third secret-key Ks3:

$$Cm1ks3 = E(Ks3, M1),$$

and is provided to a second user 19.

The second user 19 who desires to use provided encrypted edited data content Cm1ks3 requests key control center 12 for distributing third secret-key Ks3 via communication line 14. Upon receipt of the request for distributing third secret-key Ks3 from the second user 19, key control center 12 distributes third secret-key Ks3 to the second user 19 via communication line 14.

The second user 19 who has received third secret-key Ks3, decrypts encrypted edited data content Cm1ks3 using third secret-key Ks3:

$$M1 = D(Ks3, Cm1ks3)$$

and uses it.

When using encrypted data content Cm1ks3 again, decryption and encryption are carried out using third secret-key Ks3.

[Embodiment 3]

Embodiment 3 in which a user edits one original copyrighted data content and transfers it to a next user, is described as below referring to Figure 4. This embodiment uses "user label", "copyright label" and "edit label" in order to protect the data content copyright and execute the copyright. Information of the label owner is described in the user label; information relating original copyrighted data content is described in the copyright label; and information of original data content and of the edit tool and editing process data (editing scenario) are described in the edit label, which may be described edit tool (edit program) instead of edit tool information.

The user label is generated by the data management center according to the information of the user when the user joins the system. The copyright label is generated by the data management center when the creator of the data content presents the details to the data management center. The edit label is generated by the data management center, when the user who has edited the data content presents the user label and the editing scenario to the data management center. These are transferred to each label owner and are stored at the data management center.

(1) The original creator (data content owner) A presents the original copyright label Lc0 and requests the data management center to distribute original secret-key Ks0. The original creator may transfer or deposit the original data content to an information provider or to database so that the information provider or the database can play a role of the original creator.

It is also possible that the original creator A stores the original secret-key Ks0 and encrypts the original data content M0 without depending on the data management center, while the original secret-key Ks0 must be stored at the data management center for the user (data content user) to use the original data content M0.

(2) When requested to distribute the original secret-key Ks0, the data management center encrypts the original secret-key Ks0 corresponded to the original copyright label Lc0 using public-key Kb0 of the original creator A:

$$Cks0kb0 = E(Ks0, Kb0)$$

and sends the encrypted original secret-key Cks0kb0 together with the original copyright label Lc0 to the original creator A.

In this case, the data management center performs one-way hash to the original copyright label Lc0 using algorithm such as MD 5, for example, to 16-byte data amount, prepares an original copyright label fingerprint F0, and sends it to the original creator A. This electronic fingerprint is prepared on each of the original data content and edited data

content each time the data content is edited and edited data content is obtained, and is transferred, together with the data content.

(3) When the encrypted original secret-key $Cks0kb0$ is distributed, the original creator A decrypts the encrypted original secret-key $Cks0kb0$ using private-key $Kv0$ of the original creator A:

$$Ks0 = D(Cks0kb0, Kv0),$$

encrypts the original data content $M0$ using the decrypted original secret-key $Ks0$:

$$Cm0ks0 = E(M0, Ks0)$$

and transfers the encrypted original data content $Cm0ks0$, the original copyright label $Lc0$ and the original copyright label fingerprint $F0$ to the first user $U1$.

(4) When the encrypted original data content $Cm0ks0$, the original copyright label $Lc0$ and the original copyright label fingerprint $F0$ are transferred, the first user $U1$ presents the original copyright label $Lc0$, the original copyright label fingerprint $F0$ and first user label $Lu1$ and requests the data management center to distribute the original secret-key $Ks0$.

(5) When requested to distribute the original secret-key $ks0$, the data management center confirms validity of the presented original copyright label $Lc0$ using the original copyright label fingerprint $F0$ and registers the first user label $Lu1$. At the same time, the original secret-key $Ks0$ corresponding to the original copyright label $Lc0$ is encrypted using public-key $Kb1$ of the first user $U1$:

$$Cks0kb1 = E(Ks0, Kb1)$$

and the encrypted original secret-key $Cks0kb1$ is distributed to the first user $U1$.

(6) When the encrypted original secret-key $Cks0kb1$ is distributed, the first user $U1$ decrypts the encrypted original secret-key $Cks0kb1$ using private-key $Kv1$ of the first user $U1$:

$$Ks0 = D(Cks0kb1, Kv1),$$

decrypts the encrypted original data content $Cm0ks0$ using the decrypted original secret-key $Ks0$:

$$M0 = D(Cm0ks0, Ks0),$$

and edits the decrypted original data content $M0$ using the edit tool and obtains edited data content $Me1$.

The edited data content $Me1$ thus obtained contains copyright of the first user, who edited the data content, and also copyright of the original creator who prepared the original data content.

The copyright of the original creator relating to the original data content $M0$ can be protected by the registered original copyright label $Lc0$ which has been registered, original copyright label finger-

print $F0$ and the original secret-key $Ks0$ corresponded to the original copyright label $Lc0$ and also by the first user label $Lu1$ and first secret-key $Ks1$ corresponded to the first user label $Lu1$. However, because no key for encrypting the edited data content $Me1$ is available, the secondary copyright of the first user relating to the edited data content $Me1$ is not yet protected.

(7) To protect the secondary copyright of the first user relating to the edited data content $Me1$, label of the first user, who is the creator of the edited data content, and its electronic fingerprint are used in the this embodiment.

As already described, the edited data content can be expressed by data content of the utilized original data content, information of the used edit tool and the editing scenario (editing process data). Accordingly, these informations and editing scenario are entered in the first user label, i.e. the first edit label $Le1$.

Further, to protect secondary copyright in subsequent distribution process, the user $U1$ presents the first edit label $Le1$ to the data management center so that the secondary copyright of the user $U1$ is registered.

(8) When the first edit label $Le1$ is presented, the data management center confirms validity of the presented original copyright label $Lc0$ in the first edit label by using the original copyright label fingerprint $F0$ and registers the first edit label $Le1$. At the same time, the electronic fingerprint $Fe1$ of the first edit label $Le1$ is prepared, and first edit secret-key $Kse1$ corresponded to the first edit label $Le1$ is encrypted by public-key $Kb1$ of the first user $U1$ at the data management center:

$$Ckse1kb1 = E(Kse1, Kb1),$$

and the encrypted first edit secret-key $Ckse1kb1$ is distributed to the first user $U1$ together with the electronic fingerprint $Fe1$ of the first edit label $Le1$.

(9) When the encrypted first edit secret-key $Ckse1kb1$ and the electronic fingerprint $Fe1$ of the first edit label $Le1$ are distributed, the first user $U1$ decrypts the encrypted first edit secret-key $Ckse1kb1$ using private-key $Kv1$ of the first user $U1$:

$$Kse1 = D(Ckse1kb1, Kv1),$$

encrypts the first edited data content $Me1$ using the decrypted first edit secret-key $Kse1$:

$$Cme1kse1 = E(Me1, Kse1)$$

and transfers the encrypted first edited data content $Cme1kse1$ to the second user $U2$ together with the first edit label $Le1$, and the electronic fingerprint $Fe1$ of the first edit label $Le1$.

Then, the same operation is repeated. Each user may put digital signature, which one-way

hash value of the user's label is encrypted using user's private-key, on the user's label to be presented to the data management center. Then, the data management center decrypts the encrypted one-way hash value using the user's public-key, calculates the one-way hash value of the label and compares the two one-way hash values in order to verify validity of each user's label.

In this embodiment, only the first edit label Le1 and the electronic fingerprint Fe1 of the first edit label Le1 are transferred together with the encrypted first edited data content Cme1kse1 when edited data content transfer, while it is possible to arrange in such manner that the other labels and electronic fingerprints can be simultaneously transferred.

In the editing by utilizing a plurality of data contents as shown in Figure 2, operation is complicated because there are a large numbers of data contents and it can be carried out as in the editing process using a single data content. Description is not given here to avoid lengthy explanation.

In the systems described above, the data content is encrypted using the secret-key, and the secret-key for its decryption and secret-key for re-encryption used for storing, copying and transfer are distributed by the data management center based on the user label presented by the user.

[Embodiment 4]

In case of distributed object system represented by license network system, the use of network computer to perform only input/output of data content and data content processing and not provided with data content storage unit is attempted instead of conventional type computer, which possesses data content storage unit of large capacity.

Further, the use of a network computer similar to a terminal unit of large size computer, having only input/output function of data content and not provided with data content processing unit is also considered.

This network computer does not have data content storage unit and cannot store or copy the data content.

Next, description will be given on an embodiment, which can also be applied to a network computer not provided with data content storage unit and used in the distributed object system. It is needless to say that this embodiment is also applicable to an ordinary computer provided with data content storage unit.

To protect data content copyright, it is necessary to use some sort of encryption technique to restrict unauthorized utilization of the data content.

In the Embodiment 3 described above, to protect copyright in a system for an ordinary computer having data storage unit, encrypted data content and labels not encrypted as clues to utilize the data content are used.

In contrast, in a system for a network computer, which has only the function of the above-mentioned terminal unit, the data content is not stored, copied or

transferred, and there is no need to encrypt the data content.

As already explained, the editing of data content is performed by modifying the original data content using the edit tool, and edited data content thus obtained can be expressed by the utilized original data content, information of the used edit tool and the editing scenario.

In a case that edited data content is produced by utilizing the data content in the database existing on the distributed object system, the edited data content can be also reproduced by specifying the utilized database, the used original data content, information of the used edit tool and the editing scenario. The same applies to the case where a plurality of data contents obtained from a single database or a plurality of databases are utilized.

Description will be given now on Embodiment 4 referring to Figure 5. In this embodiment, the original copyright owner and the information provider holding the data content are discriminated from the user who does not hold data content, and are arranged on the network side with the data management center and the like.

In the system of this embodiment, public-key and private-key are used. If original data content is transferred to a user, the original data content is encrypted by using a secret-key or a public-key of transferred destination for the purpose of security.

The first user U1 searches the data content and collects necessary data content utilizing the network, broadcasting or recording medium. The collected data content is simply stored temporarily on memory of the user U1. Even when data content storage unit such as a hard disk drive is included in the device of the user U1, the data content is not stored in the data content storage unit.

In order that the data content is not stored, when there is an attempt to store it, inhibition of storage of the data content is performed by destroying the data content on memory, changing data header on memory, turning the data content to one-way hash value, changing file name to non-storable file name, etc.

While it is possible to inhibit the storage by data content storage inhibition program, which is incorporated in the program of the data content having object structure, higher reliability is accomplished if the storage inhibition is performed by an operating system (OS), which is related to the entire system or to the user's device.

Description will be given on a case where a plurality of data contents are utilized in this embodiment.

(1)(2)The first user U1 presents first user label Lu1 to the data management center, collects the original data content M0i (i = 1, 2, 3,) from data content library of the information provider IP in the system and obtains an edit tool Pe. In this case, the original data content M0i and the edit tool Pe

are encrypted using public-key Kb1 of the first user U1:

$$\text{Cm0ikb1} = E(M0i, \text{Kb1})$$

$$\text{Cpekb1} = E(\text{Pe}, \text{Kb1})$$

and the encrypted original data content Cm0ikb1 and the encrypted edit tool Cpekb1 are distributed to the first user U1.

The first user label Lu1 is referred, and then, utilizing condition of the original data content M0i and the edit tool Pe are recorded at the data management center and are utilized for charging of a fee.

(3) When the encrypted original data content Cm0ikb1 and the encrypted edit tool Cpekb1 are distributed, the first user U1 decrypts the distributed encrypted original data content Cm0ikb1 and the encrypted edit tool Cpekb1 using private-key Kv1 of the first user U1:

$$M0i = D(\text{Cm0ikb1}, \text{Kv1})$$

$$\text{Pe} = D(\text{Cpekb1}, \text{Kv1}).$$

Using the decrypted edit tool Pe, the decrypted original data content M0i is edited, and a first edited data content M1i (i = 1, 2, 3,) is obtained.

(4) Obtaining the first edited data content M1i, the first user U1 encrypts a first scenario S1i, which is the editing process data for the first edited data content M1i, using public-key Kbc of the data management center:

$$\text{Cs1ikbc} = E(S1i, \text{Kbc})$$

and presents the encrypted first scenario Cs1ikbc together with the first user label Lu1 to the data management center, so that secondary copyright of the user U1 is registered.

(5) When the encrypted first scenario Cs1ikbc is presented, the data management center decrypts the encrypted first scenario Cs1ikbc using private-key Kvc of the data management center:

$$S1i = D(\text{Cs1ikbc}, \text{Kvc}).$$

prepares a first edit label Le1 based on the presented user label of the first user U1 and the decrypted first scenario S1i, stores it in the data management center, encrypts the first edit label Le1 using public-key Kb1 of the first user U1:

$$\text{Cle1kb1} = E(\text{Le1}, \text{Kb1}),$$

and transfers the encrypted first edit label Cle1kb1 to the first user U1.

(6) When the encrypted first edit label Cle1kb1 is transferred, the first user U1 decrypts the encrypted first edit label Cle1kb1 using private-key Kv1 of the first user U1:

$$\text{Le1} = D(\text{Cle1kb1}, \text{Kv1}),$$

encrypts the decrypted first edit label Le1 using public-key Kb2 of the second user U2:

$$\text{Cle1kb2} = E(\text{Le1}, \text{Kb2})$$

and transfers the encrypted first edit label Cle1kb2 to the second user U2, but the first edited data content M1i or the encrypted first edited data content is not transferred to the second user U2.

When the computer of the first user U1 is provided with a data content storage unit, there is possibility that the collected original data content or the edited data content may be stored in the storage unit, however, storage inhibition as described above is carried out to exclude storage, copying and transfer.

In this case, it is possible, instead of the encrypted first edit label Cle1kb2, to use electronic fingerprint Fe1, which is obtained by turning the first edit label to one-way hash value. In so doing, it is possible to perform simplified transfer of the edit label by telephone voice.

(7) When the encrypted first edit label Cle1kb2 is transferred, the second user U2 decrypts the transferred encrypted first edit label Cle1kb2 using private-key Kv2 of the second user U2:

$$\text{Le1} = D(\text{Cle1kb2}, \text{Kv2}),$$

encrypts the first edit label Le1 using the private-key Kv2 of the second user U2:

$$\text{Cle1kv2} = E(\text{Le1}, \text{Kv2})$$

and presents the encrypted first edit label Cle1kv2 together with the second user label Lu2 to the data management center.

(8) When the encrypted first edit label Cle1kv2 and the second user label Lu2 are presented, the data management center decrypts the presented encrypted first edit label Cle1kv2 using public-key Kb2 of the second user U2:

$$\text{Le1} = D(\text{Cle1kv2}, \text{Kb2}).$$

collects the original data content M0i shown on the decrypted first edit label Le1, edits the original data content M0i using the edit tool Pe based on the first scenario S1i described on the first edit label Le1, and reproduces the first edited data content M1i.

When the first edited data content M1i is reproduced, the data management center encrypts the first edited data content M1i and the edit tool Pe using the public-key Kb2 of the second user U2:

$$\text{Cm1ikb2} = E(M1i, \text{Kb2})$$

$$\text{Cpekb2} = E(\text{Pe}, \text{Kb2})$$

and transfers the encrypted first edited data content Cm1ikb2 and the encrypted edit tool Cpekb2 to the second user U2.

(9) When the encrypted first edited data content Cm1ikb2 and the encrypted edit tool Cpekb2 are distributed, the second user U2 decrypts the distributed encrypted first edited data content Cm1ikb2 and the encrypted edit tool Cpekb2 using the private-key Kv2 of the second user U2:

$$M1i = D(\text{Cm1ikb2}, \text{Kv2})$$

$$P_e = D(C_{pek2}, K_{v2})$$

and edits the decrypted first edited data content $M1i$ using the decrypted edit tool P_e , and the second edited data content $M2i$ ($i = 1, 2, 3, \dots$) is obtained.

(10) When the second edited data content $M2i$ is obtained, the second user $U2$ encrypts the second scenario $S2i$, which is editing process data of the second edited data content $M2i$, using the public-key K_{bc} of the data management center:

$$Cs2ikbc = E(S2i, K_{bc})$$

and presents the encrypted second scenario $Cs2ikbc$ together with the second user label $Lu2$ to the data management center.

(11) When the encrypted second scenario $Cs2ikbc$ is presented, the data management center decrypts the encrypted second scenario $Cs2ikbc$ using the private-key K_{vc} of the data management center:

$$S2i = D(Cs2ikbc, K_{vc}),$$

prepares a second edit label $Le2$ based on the presented user label of the second user $U2$ and the decrypted second scenario $S2i$, stores it in the data management center, encrypts the second edit label $Le2$ using public-key K_{b2} of the second user $U2$:

$$Cle2kb2 = E(Le2, K_{b2})$$

and transfers the encrypted second edit label $Cle2kb2$ to the second user $U2$.

(12) When the encrypted second edit label $Cle2kb2$ is transferred, the second user $U2$ decrypts the encrypted second edit label $Cle2kb2$ using private-key K_{v2} of the second user $U2$:

$$Le2 = D(Cle2kb2, K_{v2}),$$

encrypts the decrypted second edit label $Le2$ using public-key K_{b3} of the third user $U3$:

$$Cle2kb3 = E(Le2, K_{b3})$$

and transfers the encrypted second edit label $Cle2kb3$ to the third user $U3$.

Then, the same operation is repeated.

In the Embodiment 4 using this distributed object system, the data content is not stored by the user, but it is stored only in the database. On the other hand, the user controls and stores only the information relating to user and editing, i.e., the edit label having information of the utilized original data content and the used edit tool, the editing scenario and the information of the user who has edited. Only this edit label is encrypted and transferred between the users. Therefore, the data content is not stored, copied or transferred.

It is also possible to simultaneously provide two systems so that the two systems can be adequately selected and utilized, i.e., a system where the key for re-encryption is distributed at the same time as the key for decryption; and a system where the key for re-encrypt-

tion is separately distributed from the key for decryption.

[Embodiment 5]

Description will be given on an embodiment of a data content dealing system for dealing in an original data content and an edited data content, referring to Figure 6.

The original data content handled in this system is an object, and the edited data content is expressed as the original data content object linked by an editing scenario. Therefore, only the editing scenario is dealt in. Upon receipt of the editing scenario, the user collects and links the original data content used according to the editing scenario and reproduces the edited data content. In this case, the original data content may be collected or linked by the user himself, but the burden on the user may be reduced if it is performed in the system side or by using an agent program.

A data content dealing center, which serves as a core of the system, comprises a data content database, an editing scenario database, a key management center, and a data content dealing management center present on a network.

The data content database stores the original data content provided by an information provider (IP) and supplies it in response to the request of the user.

The editing scenario database stores the editing scenario when the user obtained the edited data content by utilizing the original data content or user's data content created by the user and supplies it in response to the request of the user.

The key management center stores a secret key for encryption/decryption for the original data content, the user data content and the editing scenario and supplies it in response to the request of the user.

The data content dealing management center prepares a catalog and advertizes for the original data content or the edited data content and performs sales management and collecting a fee to the user, and also manages a copyright label of the data content to be stored in the data content database.

An editing scenario dealing management center prepares a catalog and advertizes for the edited data content and performs sales management and collecting a fee to the user, and further, when necessary, collects and links the original data content according to the editing scenario and manages a label for the editing scenario to be stored in the editing scenario database.

For the detailed operation of each component, which comprises the data content dealing center, description is not given here because it is the same as already explained.

(1) The information provider IP_i ($i = 1, 2, 3, \dots$; the same applies hereinafter) encrypts the original data content $M0i$ using an original secret-key $Ks0i$:

$$Cm0iks0i = E(M0i, Ks0i),$$

encrypts the corresponding original secret-key Ks_{0i} using a public-key Kbc of the data content dealing center:

$$Cks_{0ikbc} = E(Ks_{0i}, Kbc)$$

and supplies the encrypted original data content $Cm_{0iks_{0i}}$ (shown as "m0i" in the figure) and the encrypted original secret-key Cks_{0ikbc} (shown as "ks0i" in the figure) to the data content dealing center.

The original secret-key Ks_{0i} may be prepared by the information provider IP_i , or the information provider IP_i may ask the key management center to generate it. In case the key management center generates the original secret-key Ks_{0i} , the generated original secret-key Ks_{0i} is encrypted using a public-key Kb_{0i} of the information provider IP_i :

$$Cks_{0ikb_{0i}} = E(Ks_{0i}, Kb_{0i})$$

The encrypted original secret-key $Cks_{0ikb_{0i}}$ is distributed to the information provider IP_i , who decrypts it using a private-key Kv_{0i} :

$$Ks_{0i} = D(Cks_{0ikb_{0i}}, Kv_{0i})$$

and the decrypted original secret-key Ks_{0i} is used for encryption of the original data content M_{0i} .

The data content dealing center decrypts the supplied encrypted original secret-key Cks_{0ikbc} using a private-key Kvc of the data content dealing center:

$$Ks_{0i} = D(Cks_{0ikbc}, Kvc)$$

decrypts the encrypted original data content $Cm_{0iks_{0i}}$ using the decrypted original secret-key Ks_{0i} :

$$M_{0i} = D(Cm_{0iks_{0i}}, Ks_{0i})$$

and stores the decrypted original data content M_{0i} and the corresponding original secret-key Ks_{0i} in the data content database.

The information provider or the data content dealing center may add watermark to the original data content M_{0i} to check illegitimate use and may store it.

To promote utilization of the original data content, the data content dealing management center prepares a catalog by means to compress or to divide into parts so that the original data content cannot be utilized as it is and posts it in the data content dealing center.

(2) After reviewing the original data content prepared in catalog, a first user U_{1i} presents a first user label Lu_{1i} and a public-key Kb_{1i} of the first user U_{1i} , and by specifying the original data content to be utilized, requests for use to the data content dealing center.

(3) Upon receipt of the request for use of the original data content M_{0i} , the data content dealing center confirms the user label Lu_{1i} to check for fee charging and identification, and then, encrypts the original data content M_{0i} using the corresponding

original secret-key Ks_{0i} :

$$Cm_{0iks_{0i}} = E(M_{0i}, Ks_{0i})$$

encrypts the original secret-key Ks_{0i} using the public-key Kb_{1i} of the first user U_{1i} :

$$Cks_{0ikb_{1i}} = E(Ks_{0i}, Kb_{1i})$$

and distributes the encrypted original data content $Cm_{0iks_{0i}}$ and the encrypted original secret-key $Cks_{0ikb_{1i}}$ (shown as "ks0i" in the figure) to the first user U_{1i} , and also charges for the original data content utilization to the first user U_{1i} .

(4) When the encrypted original data content $Cm_{0iks_{0i}}$ and the encrypted original secret-key $Cks_{0ikb_{1i}}$ have been distributed, the first user U_{1i} decrypts the encrypted original secret-key $Cks_{0ikb_{1i}}$ using a private-key Kv_{1i} of the first user U_{1i} :

$$Ks_{0i} = D(Cks_{0ikb_{1i}}, Kv_{1i})$$

decrypts the encrypted original data content $Cm_{0iks_{0i}}$ using the decrypted original secret-key Ks_{0i} :

$$M_{0i} = D(Cm_{0iks_{0i}}, Ks_{0i})$$

and creates a new first edited data content M_{1i} using the decrypted original data content M_{0i} .

As described above, there are two cases to edit the data content: the case where a single original data content is used and the case where a plurality of original data contents are used. In these cases, the user's data content may be added. Therefore, as the data content to be used for edit in this embodiment, there are, in addition to a single data content, a plurality of original data contents, and user's data content. The edited data content comprises these data content and the editing scenario, i.e. the details of editing. By obtaining these, it is possible to reproduce the edited data content.

Incidentally, the original data content is originally stored in the data content database of the data content dealing center. Accordingly, data which is not yet stored in the data content dealing center when newly generated by editing of the data content, is the user's data content and the editing scenario.

Therefore, by storing these in the data content dealing center, it is possible to handle the first user's data content of the user who edited the data content, in the same manner as the original data content, and the user can be also an information provider.

(5) The first edited data content M_{1i} comprises the original data content M_{0i} and a first editing scenario S_{1i} . Further, in some cases, the first user's data content Mu_{1i} is added as a comprising element.

Among these elements, the original data content M_{0i} is stored in the data content database of the data content dealing center. Accordingly, what is to be stored newly in the data content dealing

center includes the first editing scenario $S1i$ and the first user's data content $Mu1i$.

For this purpose, the first user $U1i$ prepares a first secret-key $Ks1i$, encrypts the first editing scenario $S1i$ and the first user's data content $Mu1i$ using the first secret-key $Ks1i$:

$$Cs1iks1i = W(S1i, Ks1i)$$

$$Cmu1iks1i = E(Mu1i, Ks1i),$$

encrypts the first secret-key $Ks1i$ using the public-key Kbc of the data content dealing center:

$$Cks1ikbc = E(Ks1i, Kbc)$$

and transfers the encrypted first editing scenario $Cs1iks1i$ (shown as "s1i" in the figure), the encrypted first user's data content $Cmu1iks1i$ (shown as "m1i" in the figure), and the encrypted first secret-key $Cks1ikbc$ (shown as "ks1i" in the figure) to the data content dealing center.

The first secret-key $Ks1i$ may be prepared by the first user $U1i$, or the first user $U1i$ may ask the key management center to generate it. In case the key management center generates the first secret-key $Ks1i$, the generated first secret-key $Ks1i$ is encrypted using the public-key $Kb1i$ of the first user $U1i$:

$$Cks1ikb1i = E(Ks1i, Kb1i)$$

and the encrypted first secret-key $Cks1ikb1i$ is distributed to the first user $U1i$. The first user $U1i$ decrypts it using the private-key $Kv1i$:

$$Ks1i = D(Cks1ikb1i, Kv1i)$$

and the decrypted first secret-key $Ks1i$ is used to encrypt the first editing scenario $S1i$ and the first user's data content $Mu1i$.

The data content dealing center decrypts the transferred encrypted first secret-key $Cks1ikbc$ using the private-key Kvc of the data content dealing center:

$$Ks1i = D(Cks1ikbc, Kvc)$$

decrypts the encrypted first editing scenario $Cs1iks1i$ and the encrypted first user's data content $Cmu1iks1i$ using the decrypted first secret-key $Ks1i$:

$$S1i = D(Cs1iks1i, Ks1i)$$

$$Mu1i = D(Cmu1iks1i, Ks1i)$$

and generates a first user data content label and a first editing scenario label according to a first user label, and the decrypted first secret-key $Ks1i$, the first editing scenario $S1i$, the first user's data content $Mu1i$, the first user data content label and the first editing scenario label are stored in the database.

The first user or the data content dealing center may add watermark to the original data content $M0i$ to check illegitimate use and may store it.

The database where the first secret-key $Ks1i$, the first editing scenario $S1i$ and the first user's data content $Mu1i$ are to be stored may be the data content database where the original data content $M0i$ is stored, or another editing scenario database may

be provided to store them.

To promote utilization of the first edited data content, the data content dealing management center prepares a catalog by means to compress or to divide into parts so that the first edited data content cannot be used as it is and posts it in the data content dealing center.

(6) After reviewing the original data content $M0i$ and the first edited data content $M1i$ prepared in catalog, a second user $U2i$ presents a second user label $Lu2i$ and a public-key $Kb2i$ of the second user $U2i$. By specifying the original data content $M0i$ and/or the first edited data content $M1i$ to be utilized, a request for use is sent to the data content dealing center.

(7) Upon receipt of the request for use of the original data content $M0i$ and/or the first edited data content $M1i$, the data content dealing center confirms the user label $Lu2i$ to check for fee charging and identification. Then, the original data content $M0i$ requested for use, is encrypted using the corresponding original secret-key $Ks0i$. The first editing scenario $S1i$ and the first user's data content $Mu1i$ are encrypted using the first secret-key $Ks1i$, the original secret-key $Ks0i$ is encrypted using a public-key $Kb2i$, and the first secret-key $Ks1i$ is encrypted using the public-key $Kb2i$:

$$Cm0iks0i = E(M0i, Ks0i)$$

$$Cs1iks1i = E(S1i, Ks1i)$$

$$Cmu1iks1i = E(Mu1i, Ks1i)$$

$$Cks0ikb2i = E(Ks0i, Kb2i)$$

$$Cks1ikb2i = E(Ks1i, Kb2i).$$

Then, the encrypted original data content $Cm0iks0i$ (shown as "m0i" in the figure), the encrypted first editing scenario $Cs1iks1i$ (shown as "s1i" in the figure), the encrypted first user's data content $Cmu1iks1i$ (shown as "mu1i" in the figure), the encrypted original secret-key $Cks0ikb2i$ and the encrypted first secret-key $Cks1ikb2i$ are transferred to the second user $U2i$. And then, the data content dealing center charges for utilization of the original data content $M0i$ and the first editing scenario $S1i$ to the second user $U2i$.

(8) When the encrypted original data content $Cm0iks0i$, the encrypted first editing scenario $Cs1iks1i$, the encrypted first user's data content $Cmu1iks1i$, the encrypted original secret-key $Cks0ikb2i$ and the encrypted first secret-key $Cks1ikb2i$ have been transferred, the second user $U2i$ decrypts the encrypted original secret-key $Cks0ikb2i$ and the encrypted first secret-key $Cks1ikb2i$ using a private-key $Kv2i$ of the second user $U2i$:

$$Ks0i = D(Cks0ikb2i, Kv2i)$$

$$Ks1i = D(Cks1ikb2i, Kv2i).$$

Next, the encrypted original data content $Cm0iks0i$ is decrypted using the decrypted original secret-key $Ks0i$, and the encrypted first editing scenario $Cs1iks1i$ and the encrypted first user's data content $Cmu1iks1i$ are decrypted using the decrypted first secret-key $Ks1i$:

$$M0i = D(Cm0iks0i, Ks0i)$$

$$S1i = D(Cs1iks1i, Ks1i)$$

$$Mu1i = D(Cmu1iks1i, Ks1i)$$

and a new second edited data content $M2i$ is created by utilizing the decrypted original data content $M0i$, the first editing scenario $S1i$ and the first user's data content $Mu1i$.

The second user $U2i$ prepares a second secret-key $Ks2i$ and encrypts a new second editing scenario $S2i$ and a second user's data content $Mu2i$, not stored in the database of the data content dealing center, using the second secret-key $Ks2i$:

$$Cs2iks2i = E(S2i, Ks2i)$$

$$Cmu2iks2i = E(Mu2i, Ks2i).$$

Then, the second secret-key $Ks2i$ is encrypted using the public-key Kbc of the data content dealing center:

$$Cks2ikbc = E(Ks2i, Kbc)$$

and the encrypted second editing scenario $Cs2iks2i$ (shown as "s2i" in the figure), the encrypted second user's data content $Cmu2iks2i$ (shown as "mu2i" in the figure), and the encrypted second secret-key $Cks2ikbc$ (shown as "ks2i" in the figure) are transferred to the data content dealing center.

Then, the same procedure is repeated.

[Example 6]

Description will be given on this embodiment in which a data content editor sells a utilization right of an editing scenario by auction in the data content market, referring to Figure 7. In the embodiment, the utilization right of an editing scenario is auctioned on the market in the system, and an editing scenario seller who obtains the utilization right of the editing scenario sells or lends the editing scenario to a user.

The original data content handled in the present system is an object, and the edited data content is expressed as the original data content object linked by the editing scenario. Therefore, only the editing scenario is dealt in. When the editing scenario has been purchased or lent, the user collects and links the original data content used in accordance with the editing scenario and reproduces the edited data content. In this case, the original data content may be collected by the user himself, but the burden on the user may be reduced if it is performed in the system side or by using an agent program.

A data content deals center, which serves as a core of the system, comprises a key management center, a data content database, a data content dealing management center, an editing scenario database, and an edit-

ing scenario market management center present on the network.

The data content database stores the original data content provided by an information provider (IP) and supplies it to a data content editor.

The editing scenario database stores the editing scenario when the data content editor obtains the edited data content by utilizing the original data content or the editor's data content created by the data content editor, and supplies it to the editing scenario sellers, who participate in auction.

The key management center stores a secret-key for encryption/decryption for the original data content, the editor's data content and the editing scenario and supplies it to the data content editor or the editing scenario seller.

The data content dealing management center prepares a catalog and advertizes for the original data content and manages sales for the data content editor.

The editing scenario market management center prepares a catalog and advertizes for the edited data content, and manages editing scenario auction and collects a fee. Further, the editing scenario market management center collects and links the original data content according to the editing scenario, when necessary, and also manages a label for the editing scenario which is to be stored in the editing scenario database.

For the detailed operation of each component, which comprises the data content dealing center, description is not given here because it is the same as already explained.

(1) The information provider IPi ($i = 1, 2, 3, \dots$; the same applies hereinafter) encrypts the original data content $M0i$ using an original secret-key $Ks0i$:

$$Cm0iks0i = E(M0i, Ks0i),$$

encrypts the corresponding original secret-key $Ks0i$ using a public-key Kbc of the data content dealing center:

$$Cks0ikbc = E(Ks0i, Kbc)$$

and supplies the encrypted original data content $Cm0iks0i$ (shown as "m0i" in the figure) and the encrypted original secret-key $Cks0ikbc$ (shown as "ks0i" in the figure) to the data content dealing center.

The original secret-key $Ks0i$ may be prepared by the information provider IPi , or the information provider IPi may ask the key management center to generate it. In case the key management center generates the original secret-key $Ks0i$, the generated original secret-key $Ks0i$ is encrypted using a public-key $Kb0i$ of the information provider IPi :

$$Cks0ikb0i = E(Ks0i, Kb0i).$$

The encrypted original secret-key $Cks0ikb0i$ is distributed to the information provider IPi , and is decrypted using a private-key $Kv0i$ of the IPi :

$$Ks0i = D(Cks0ikb0i, Kv0i)$$

and the decrypted original secret-key $Ks0i$ is used

for encryption of the original data content $M0i$.

The data content dealing center decrypts the supplied encrypted original secret-key $Cks0ikbc$ using a private-key Kvc of the data content dealing center:

$$Ks0i = D(Cks0ikbc, Kvc),$$

decrypts the encrypted original data content $Cm0iks0i$ using the decrypted original secret-key $Ks0i$:

$$M0i = D(Cm0iks0i, Ks0i)$$

and stores the decrypted original data content $M0i$ and the corresponding original secret-key $Ks0i$ to the data content database.

The information provider or the data content dealing center may add watermark to the original data content $M0i$ to check illegitimate use and may store it.

To promote utilization for editing of the original data content, the data content dealing management center prepares a catalog by means to compress or to divide into parts so that the original data content cannot be utilized as it is and posts it in the data content dealing center.

(2) After reviewing the original data content prepared in catalog, the data content editor Ei presents a data content editor label Lei and a public-key $Kb1i$ of the data content editor Ei , and requests for utilization by specifying the original data content to be utilized, to the data content dealing center.

(3) Upon receipt of the request for utilization of the original data content $M0i$, the data content dealing center confirms the user label Lei to check for fee charging and identification. Then, the original data content $M0i$ is encrypted using the corresponding original secret-key $Ks0i$:

$$Cm0iks0i = E(M0i, Ks0i),$$

encrypts the original secret-key $Ks0i$ using a public-key $Kbei$ of the data content editor Ei :

$$Cks0ikbei = E(Ks0i, Kbei)$$

and distributes the encrypted original data content $Cm0iks0i$ and the encrypted original secret-key $Cks0ikbei$ (shown as "ks0i" in the figure9 to the data content editor Ei , and further, charges a fee for the original data content utilization to the data content editor Ei and an end user.

(4) When the encrypted original data content $Cm0iks0i$ and the encrypted original secret-key $Cks0ikbei$ have been distributed, the data content editor Ei decrypts the encrypted original secret-key $Cks0ikbei$ using a private-key $Kvei$ of the data content editor Ei :

$$Ks0i = E(Cks0ikbei, Kvei),$$

decrypts the encrypted original data content $Cm0iks0i$ using the decrypted original secret-key $Ks0i$:

$$M0i = D(Cm0iks0i, Ks0i)$$

and creates an edited data content Mei utilizing the decrypted original data content $M0i$.

As described above, there are two cases to edit the data content: the case where a single original data content is used and the case where a plurality of original data contents are used. In these cases, the data content of the data content editor may be added. Therefore, as the data content to be used for editing in this embodiment, there are, in addition to a single data content, a plurality of original data contents and the data content of the data content editor. The edited data content comprises these data contents and the editing scenario, i.e. the detail of editing. By obtaining these, it is possible to reproduce the edited data content.

Incidentally, the original data content is originally stored in the data content database of the data content dealing center. Accordingly, data which is not yet stored in the data content dealing center is, when newly generated by editing the data content, is the editor's data content of the data content editor and the editing scenario.

Therefore, by storing these in the data content dealing center, it is possible to handle the editor's data content of the data content editor who has edited the data content in the same manner as the original data content, and the data content editor can be an information provider. Further, it is also possible to sell utilization right of the editing scenario and/or the editor's data content by auction in the market. In this case, the utilization right of the editing scenario and the editor's data content may be plural for a single edited data content.

(5) The edited data content Mei comprises the original data content $M0i$ and the editing scenario Sei . Further, in some cases, the editor's data content $Medi$ is added as a comprising element.

Among these elements, the original data content $M0i$ is stored in the data content database of the data content dealing center. Accordingly, what is to be stored newly in the data content dealing center is the editing scenario Sei and the editor's data content $Medi$.

To sell the utilization right of the editing scenario Sei and the editor's data content $Medi$, the data content editor Ei prepares a secret-key $Ksei$, encrypts the editing scenario Sei and the editor's data content $Medi$ using the secret-key $Ksei$:

$$Cseiksei = E(Sei, Ksei)$$

$$Cmediksei = E(Medi, Ksei)$$

and encrypts the secret-key $Ksei$ using the public-key Kbc of the data content dealing center:

$$Ckseikbc = E(Ksei, Kbc).$$

Then, the encrypted editing scenario $Cseiksei$ (shown as "sei" in the figure), the encrypted editor's data content $Cmediksei$ (shown as "medi" in the fig-

ure), and the encrypted secret-key $Cksei_{kbc}$ (shown as "ksej" in the figure) are transferred to the data content dealing center.

The secret-key $Ksei$ may be prepared by the data content editor Ei , or the data content editor Ei may ask the key management center to generate it. In case the key management center generates the secret-key $Ksei$, the generated secret-key $Ksei$ is encrypted using the public-key $Kbei$ of the data content editor Ei :

$$Cksei_{kbei} = E(Ksei, Kbei)$$

and the encrypted secret-key $Cksei_{kbei}$ is distributed to the data content editor Ei . The data content editor Ei decrypts it using own private-key $Kvei$:

$$Ksei = D(Cksei_{kbei}, Kvei)$$

and the decrypted secret-key $Ksei$ is used to encrypt the editing scenario Sei and the editor's data content $Medi$.

The data content dealing center decrypts the transferred encrypted secret-key $Cksei_{kbc}$ using the private-key Kvc of the data content dealing center:

$$Ksei = D(Cksei_{kbc}, Kvc)$$

Then, the encrypted editing scenario $Csei_{ksei}$ and the encrypted editor's data content $Cmediksei$ are decrypted using the decrypted secret-key $Ksei$:

$$Sei = D(Csei_{ksei}, Ksei)$$

$$Medi = D(Cmediksei, Ksei)$$

Then, a copyright label based on the data content editor label Lei is added to each of the decrypted secret-key $Ksei$, the editing scenario Sei and the editor's data content $Medi$, and these are stored in the database.

The data content editor or the data content dealing center may add watermark to the editing scenario Sei and the editor's data content $Medi$ to check illegitimate use and may store them.

The database where the secret-key $Ksei$, the editing scenario Sei and the editor's data content $Medi$ are to be stored may be the data content database where the original data content $M0i$ is stored, or another scenario database may be provided to store them.

For auction of the editing scenario and the editor's data content, the editing scenario market management center in the data content dealing center prepares a catalog by means to compress or to divide into parts so that the edited data content cannot be utilized as it is and posts it shown the number of the selling utilization rights, in the editing scenario market management center to announce the auction.

(6) After reviewing the edited data content Mei prepared in catalog, each of a plurality of editing scenario sellers Di presents an editing scenario seller label Ldi and a public-key $Kbdi$ of the editing scenario seller Di and requests to purchase the editing

scenario Sei and the editor's data content $Medi$ to the editing scenario market management center.

(7) Upon receipt of the request to purchase the editing scenario Sei and the editor's data content $Medi$, the editing scenario market management center confirms the editing scenario seller label Ldi to check for fee charging and identification, performs the auction on the network, and sells the utilization right of the editing scenario Sei and the editor's data content $Medi$ to a plurality of editing scenario sellers Di .

As described above, the utilization right of the editing scenario and the editor's data content may be plural for a single edited data content.

The editing scenario seller Di , to whom it has been decided to sell, encrypts the secret-key $Ksdi$ of the editing scenario seller Di using the public-key $Kbdc$ of the data content dealing center:

$$Cksd_{kbc} = E(Ksdi, Kbdc)$$

and transfers the encrypted secret-key $Cksd_{kbc}$ (shown as "ksdi" in the figure) to the editing scenario market management center.

(8) The editing scenario market management center decrypts the presented encrypted secret-key $Cksd_{kbc}$ using the private-key Kvc of the data content dealing center:

$$Ksdi = D(Cksd_{kbc}, Kvc)$$

encrypts the editing scenario Sei and the editor's data content $Medi$ using the decrypted secret-key $Ksdi$ of the editing scenario seller Di :

$$Csei_{ksdi} = E(Sei, Ksdi)$$

$$Cmediksdi = E(Medi, Ksdi)$$

and sends the encrypted editing scenario $Csei_{ksdi}$ and encrypted editor's data content $Cmediksdi$ to the editing scenario seller Di .

Also, the content of the copyright label is changed from the one based on the data content editor label Lei to the one based on the editing scenario seller label Ldi . As a result, the secret-key $Ksei$ of the data content editor cannot be used any more, and the secret-key $Ksdi$ of the editing scenario seller can be used substantially. In this case, instead of changing the content of the copyright label, it may be newly added based on the editing scenario seller label Ldi .

The editing scenario seller who purchases the encrypted editing scenario $Csei_{ksdi}$ executes thereafter the utilization right of the purchased editing scenario. The original data content can also be sold by auction in the same manner as the editing scenario. However, it is preferable to avoid to sell to a specific seller because there may be a plurality of users utilizing the original data content.

Then, the same procedure may be repeated if necessary.

In the data content dealing system described in

each embodiment of the present application, in case that for a user device, a network computer without a storing unit such as a hard disk drive is used, the illegitimate use, i.e., using without pay or leakage of the data content hardly occurs. However, in case that for a user device, a general computer having a storing unit such as a hard disk drive is used, there is a possibility of problems such like these illegitimate use.

In cope with such problems, adopting a copyright management program and re-encryption of the data content is effective as the present inventor has proposed in the U.S. Patent Application Serial No.08/416,037 (EP 677949A2), and if adopting an arrangement referred to as a realtime OS or an embedded system which allows the copyright management program performing re-encryption to precede other application programs, the illegitimate use problems can be effectively avoided.

Claims

1. Data content dealing system in which an original data content and an edited data content into which a first user has edited said original data content are sold in a network to a second user, comprising :

- a data content dealing center with:

- a key management center generating, storing and transferring a secret-key;
- a data content dealing management center advertizing and selling said data content stored in a database; and
- an editing scenario dealing management center advertizing and selling an editing scenario, and

- a database, comprising:

- the original data content as a data object; and
- the edited data content comprising:
- said data object and
- an editing scenario of editing details of said data object;

wherein said first user creates the edited data content using said original data content and encrypts an editing scenario of said edited data content by a secret-key which is to be deposited in said database and deposits said secret-key in said key management center; said encrypted editing scenario and said secret-key are transferred to the second user; and said second user decrypts said encrypted editing scenario by said secret-key and

re-constitutes said edited data content according to said decrypted editing scenario.

2. Data content dealing system according to claim 1, wherein said original data content is transferred to the second user together with said encrypted editing scenario and said secret-key.

3. Data content dealing system, in which a utilization right of an editing scenario on an edited data content into which a data content editor has edited an original data content comprising a data object is auctioned in a network for an editing scenario seller, wherein said edited data content comprises said data object and the editing scenario describing the editing details thereof, comprising:

- a data content dealing center comprising:

- a key management center for generation, storage and transfer of said secret-key;
- a data content dealing management center to advertise and sell said data content stored in a database and to transfer;
- an editing scenario market management center to advertise and auction said editing scenario (for said editing scenario seller) and to change the secret-key for said editing scenario from the data content editor's secret-key into the scenario seller's secret-key; and

- a database comprising:

- an original data content comprising a data object; and
- an edited data content with said data object and the editing scenario describing editing details of said object;

wherein by said data content editor: said editing data content is produced using said original data content; the editing scenario of said edited data content is encrypted by one of his secret-keys and deposited in said database and said secret-key is deposited in said key management center.

4. Data content dealing system according to claim 1 or claim 3, wherein said database comprises a data content database storing a data content and an editing scenario database storing editing scenarios.

5. Process for dealing with data contents selling original data and an edited data content in which a first user has edited said original data content in a net-

work to a second user, comprising

- providing:
a data content dealing center comprising: 5
 - a key management center, generating storing and transferring of a secret-key;
 - a data content dealing management center for advertising and selling said data content ; and 10
 - an editing scenario dealing management center for advertising and selling of an editing scenario; and 15
- a database comprising:
the original data content as data object;
and
the edited data content comprising said data object and an editing scenario of editing details of said data object; 20
- creating an edited data content using said original data content stored in said database, 25
- encrypting an editing scenario of said edited data content by a secret-key which is to be deposited in said database 30
- depositing said secret-key in said key management center by said first user;
- transferring said encrypted editing scenario and said secret-key to the second user who wishes to use said edited data content; and 35
- decrypting said encrypted editing scenario by said secret-key and re-constitution of said edited data content according to said decrypted editing scenario by said second user. 40

6. Process according to claim 5, further comprising: 45

- transferring said original data content to a second user together with said encrypted editing scenario and said secret-key.

7. Process for dealing data contents, in which a utilization right of an editing scenario on an edited data content which a data content editor has edited from an original data content stored in a database is auctioned in a network for an editing scenario seller, comprising: 50

- providing a data content dealing system comprising: 55

- a data content dealing center comprising:

- a key management center for generation, storage and transfer of a secret-key;
- a data content dealing management center to advertise and sell said data content stored in said database;
- an editing scenario market management center to advertise and auction said editing scenario and to change the secret-key for said editing scenario from the data content editor's secret-key into the scenario seller's secret-key; and

- a database comprising

- the original data content as a data object; and
- said edited data content with said data object and the editing scenario describing editing details of said data object;

- producing the edited data content by using said original data content stored in said database,

- encrypting the editing scenario of said edited data content by his secret-key, depositing the encrypted editing scenario in said database and depositing said secret-key in said key management center by said data content editor

- auctioning and transferring of his secret-key for said editing scenario to said key management center for said editing scenario seller wishing to sell said utilization right of said editing scenario by an editing scenario market management center; and.

- changing the data content editor's secret-key into the editing scenario's seller's key by said editing scenario dealing management center.

8. Process according to claim 7, further comprising :

- providing in said database:

- an editing scenario database storing an editing scenario and
- a data content database storing a data content

Fig. 1

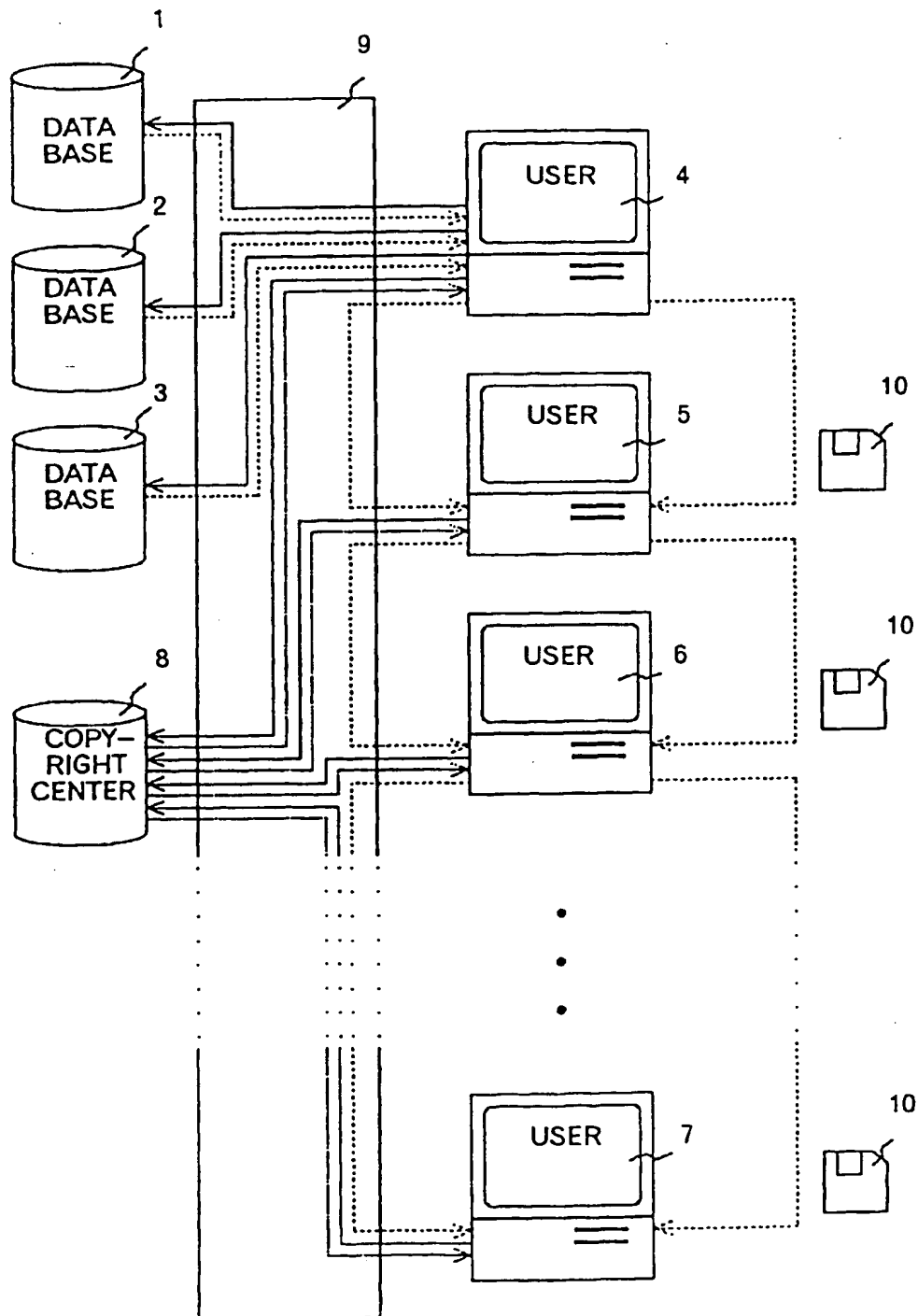


Fig. 2

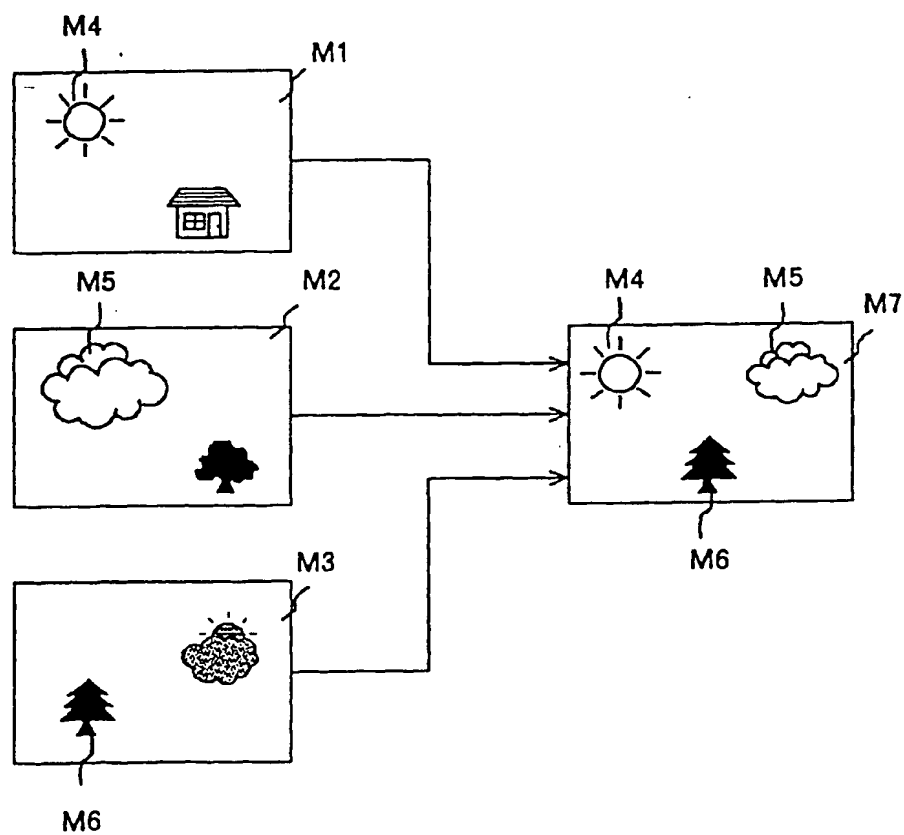


Fig. 3

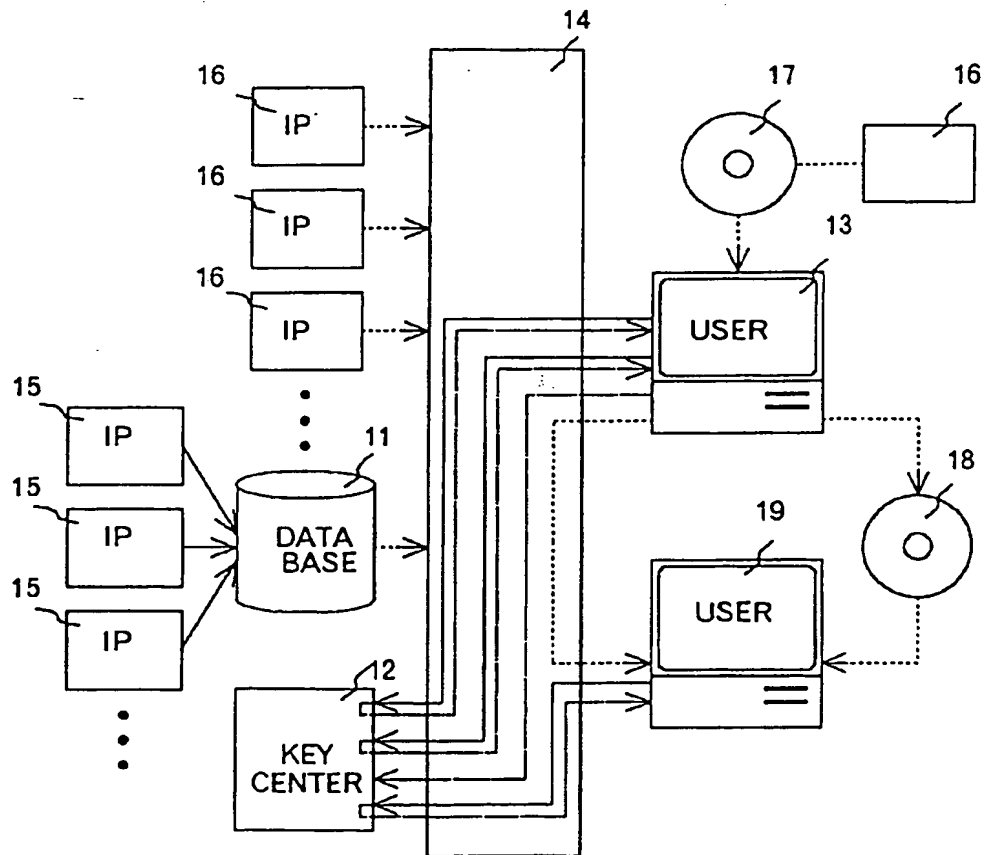


Fig. 4

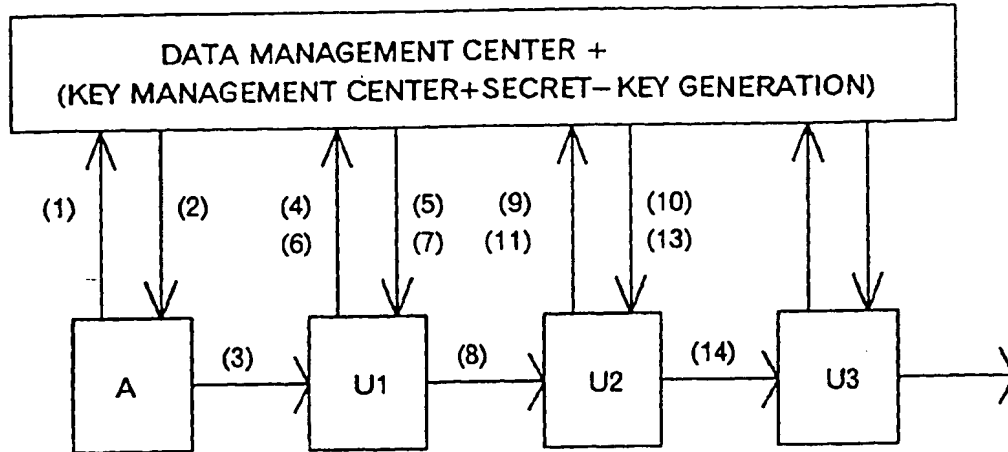


Fig. 5

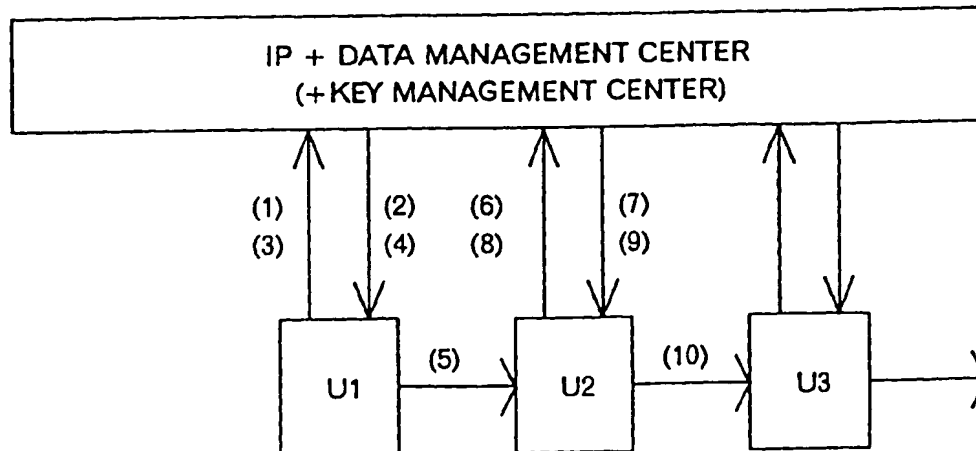


Fig. 6

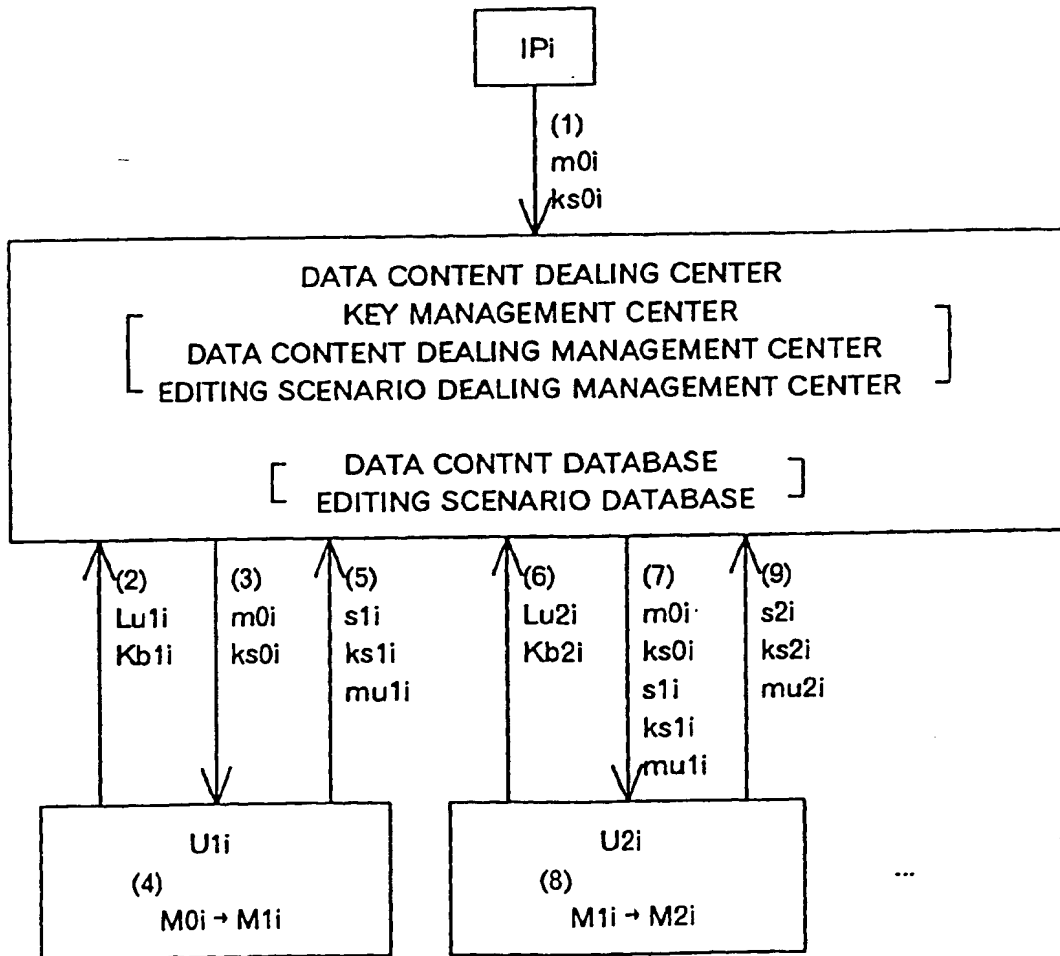


Fig. 7

